

AMENDMENTS TO THE CLAIMS

1. (Original) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

a) an electric field-to-light-to-voltage converter comprising:

1) a light source;

2) an electro-optic material:

(a) receiving light from said light source;

(b) modulating said light; and

(c) providing a modulated light output;

3) an electric field applied to said electro-optic crystal by means of electrodes formed on said electro-optic material to modulate said light from said light source to produce said modulated light output;

b) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material; c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time; and

d) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root mean square voltage of said applied electric field.

2. (Original) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

a) an electric field-to-light-to-voltage converter comprising:

1) a light source;

2) an electro-optic material:

(a) receiving light from said light source;

(b) modulating said light; and

(c) providing a modulated light output;

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- 3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;
- b) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;
- c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time; and
- d) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root mean square voltage of said applied electric field and wherein said third voltage is used to control the intensity of said light source.

3. (Original) The opto-electric device for measuring the root mean square value of an alternating current voltage according to claim 2 wherein said electro-optic material is an anisotropic lithium niobate crystal.

4. (Original) The opto-electric device for measuring the root mean square value of an alternating current voltage according to claim 3 wherein a Mach-Zehnder interferometer is formed in said lithium niobate crystal.

5. (Original) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

- a) an electric field-to-light-to-voltage converter comprising:
 - 1) a light source;
 - 2) an electro-optic material:
 - (a) receiving light from said light source;
 - (b) modulating said light; and
 - (c) providing a modulated light output;

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- 3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;
- b) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;
- c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time;
- d) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root mean square voltage of said applied electric field;
- e) an environmental container for said electro-optic material; and
- f) a temperature control unit for maintaining a set temperature within said environmental container.

6.(Original) The opto-electric device for measuring the root mean square value of an alternating current voltage according to claim 5 with said environmental container having therein a temperature sensor.

7. (Original) The opto-electric device for measuring the root mean square value of an alternating current voltage according to claim 5 with said environmental container having therein a heating device.

8. (Original) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

- a) an electric field-to-light-to-voltage converter comprising:
 - 1) a light source;
 - 2) an electro-optic material:
 - (a) receiving light from said light source;
 - (b) modulating said light; and
 - (c) providing a modulated light output;

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- 3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;
- b) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;
- c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time;
- d) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root mean square voltage of said applied electric field; and
- e) a biasing voltage applied to said electro-optic material for setting said electro-optic material to provide essentially zero modulated output.

9. (Original) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

a) an electric field-to-light-to-voltage converter comprising:

- 1) a light source;
- 2) an electro-optic material:
 - (a) receiving light from said light source;
 - (b) modulating said light; and
 - (c) providing a modulated light output;

3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;

- b) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;
- c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time;

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d) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root mean square voltage of said applied electric field; and

e) an ac calibration source with analog to digital conversion for applying a known ac voltage at a known frequency to said electro-optic material.

10. (Previously Presented) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

a) an electric field-to-light-to-voltage converter comprising:

1) a light source;

2) an electro-optic material:

(a) receiving light from said light source;

(b) modulating said light; and

(c) providing a modulated light output;

3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;

b) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;

c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time;

d) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root mean square voltage of said applied electric field; and

e) a voltage lookup table for correcting said output voltage.

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11. (Previously Presented) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

a) an electric field-to-light-to-voltage converter comprising:

1) a light source;

2) an electro-optic material:

(a) receiving light from said light source;

(b) modulating said light; and

(c) providing a modulated light output;

3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;

b) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;

c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time;

d) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root mean square voltage of said applied electric field; and

e) a frequency lookup table for correcting said voltage output.

12. (Previously Presented) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

a) an electric field-to-light-to-voltage converter comprising:

1) a light source;

2) an integrated electro-optic material:

(a) receiving light from said light source;

(b) processing and modulating said light; and

(c) providing a modulated light output;

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- 3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;
- b) an optical detector receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;
- c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time; and
- d) one or more circuits interconnected with said averager circuit for providing an output voltage that is the root mean square voltage of said applied electric field.

13. (Original) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

a) an electric field-to-light-to-voltage converter comprising:

- 1) a light source;
- 2) an electro-optic material having formed therein a Mach-Zehnder-type interferometer, said interferometer comprising:
 - (a) an input waveguide for receiving light from said light source;
 - (b) a first waveguide leg and a second waveguide leg divided from said input waveguide for modulating said light; and
 - (c) and output waveguide combining said first waveguide leg and said second waveguide leg to provide a modulated light output; and
 - (d) said interferometer operating as a squarer device;

- 3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;
- b) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;
- c) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time; and

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d) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root-mean-square voltage of said applied electric field.

14. (Original) The opto-electric device for measuring the root-mean-square value of an alternating current voltage according to claim 13 wherein said interferometer is made to operate as a squarer device by making said first waveguide leg longer than said second waveguide leg.

15. (Original) The opto-electric device for measuring the root-mean-square value of an alternating current voltage according to claim 13 wherein said interferometer is made to operate as a squarer device by providing a biasing voltage to said interferometer.

16. (Canceled)

17. (Canceled)

18. (Canceled)

19. (Canceled)

20. (Canceled)

21. (New) An opto-electric device for measuring the root mean square value of an alternating current voltage comprising:

a) an electric field-to-light-to-voltage converter comprising:

1) a light source;

2) an electro-optic material:

(a) receiving light from said light source;

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- (b) modulating said light; and
- (c) providing a modulated light output;
- 3) an electric field applied to said electro-optic crystal to modulate said light from said light source to produce said modulated light output;
- 4) an optical receiver for receiving and converting said modulated output light from said electro-optic material to a first voltage that is proportional to a square of said electric field applied to said electro-optic material;
- b) an averager circuit receiving said first voltage and providing a second voltage that is proportional to the average of said square of said electric field over a period of time; and
- c) an inverse ratiometric circuit receiving said second voltage from said averager circuit and returning a third voltage that is an inverse voltage of said second voltage to said electric field-to-light-to-voltage converter to produce an output voltage that is the root mean square voltage of said applied electric field.